

WHAT IS CLAIMED IS:

- 1 1. A nanowire switching device comprising:
2 a nanowire structure comprising an elongated member having a cross-sectional
3 diameter ranging from about 1 nanometers but less than about 300 nanometers;
4 a first terminal coupled to a first portion of the nanowire structure;
5 a second terminal coupled to a second portion of the nanowire structure, the
6 second portion of the nanowire structure being disposed spatially from the first portion of the
7 nanowire structure; and
8 an active surface structure coupled to the nanowire structure, the active surface
9 structure extending from the first portion to the second portion along the elongated member,
10 whereupon the nanowire structure has a first electrical value as measured between the first
11 terminal and the second terminal while the active surface is subjected to a first environment, the
12 nanowire structure having a second electrical value as measured between the first terminal and
13 the second terminal while the active surface is subjected to a second environment, the second
14 environment being different from the first environment.
- 1 2. The device of claim 1 wherein the device is a switch, a sensor, a chemical
2 sensor, photo-detector, an opto-electronic device, MEMS, MEOMS, and _____.
- 1 3. The device of claim 1 wherein the device is a humidity sensor or an
2 oxygen sensor.
- 1 4. The device of claim 1 wherein the nanowire structure is characterized by a
2 shape of a nanowire.
- 1 5. The device of claim 1 wherein the active surface is about 10% to 90% of a
2 total surface area of the nanowire structure.
- 1 6. The device of claim 1 wherein the cross-sectional diameter ranges from
2 about 1 nm to 500 nm.
- 1 7. The device of claim 1 wherein the nanowire structure has an aspect ratio
2 (length to diameter) of 10 to 1000.

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- 1 8. The device of claim 1 wherein the nanowire is made of a material that
2 substantially single crystal.
- 1 9. The device of claim 1 wherein the nanowire is made of a material that is
2 polycrystalline.
- 1 10. The device of claim 1 wherein the nanowire structure is made of a
2 material that is a semiconductor.
- 1 11. The device of claim 10 wherein the semiconductor material is ZnO, SiGe,
2 Si, Ge, SnO₂, GaN, PbSe, PbS, or Bi₂Te₃.
- 1 12. The device of claim 1 wherein nanowire structure comprises at least a first
2 material and a second material that are spatially separated from each other.
- 1 13. The device of claim 1 wherein the nanowire structure is made of a
2 homogeneous material.
- 1 14. The device of claim 1 wherein the nanowire is heterogeneous in texture.
- 1 15. The device of claim 1 wherein the second environment comprises an
2 intensity level, the intensity level being proportional to the second electrical value, the second
3 electrical value comprising an electrical current and the second environment comprising electro-
4 magnetic radiation.
- 1 16. The device of claim 1 wherein the device is operable at room temperature.
- 1 17. The device of claim 1 wherein the device is substantially free from high
2 temperature thermal elements.
- 1 18. The device of claim 1 wherein the device is operable at 0 to 100 Degrees
2 Celsius.
- 1 19. A method for switching an opto-electronic device, the method comprising:

2 providing a nanowire structure having a surface region, the surface region having
3 a first chemical species attached to the surface region of the nanowire structure, the nanowire
4 structure having the first chemical species providing a first electrical state of the nanowire
5 structure; and

6 illuminating energy onto the surface area of the nanowire structure to change the
7 nanowire structure having the first chemical species from the first electrical state to a second
8 electrical state whereupon the second electrical state allows a conduction characteristic of the
9 nanowire to change from the first electrical state to the second electrical state.

1 20. The method of claim 19 wherein the illuminating releases a portion of the
2 first chemical species from the surface area of the nanowire structure.

1 21. The method of claim 19 wherein the illuminating converts the first
2 chemical species into the second chemical species.

1 22. The method of claim 19 wherein the first chemical species can be selected
2 from oxygen, NO₂, H₂O, NO, or SO₂.

1 23. The method of claim 19 wherein the energy is electro-magnetic radiation.

1 24. The method of claim 19 wherein the nanowire structure is made of a
2 semiconductor material.

1 25. The method of claim 24 wherein the semiconductor material is selected
2 from is ZnO, SiGe, Si, Ge, SnO₂, TiO₂, or GaN.

1 26. The method of claim 19 wherein the nanowire structure is single
2 crystalline or polycrystalline.

1 27. A nanowire opto-electronic switching device comprising:
2 a nanowire structure comprising an elongated member having a cross-sectional
3 diameter ranging from about 1 nanometers but less than about 300 nanometers;
4 a first terminal coupled to a first portion of the nanowire structure;

5 a second terminal coupled to a second portion of the nanowire structure, the
6 second portion of the nanowire structure being disposed spatially from the first portion of the
7 nanowire structure; and
8 an active surface structure coupled to the nanowire structure, the active surface
9 structure extending from the first portion to the second portion along the elongated member,
10 whereupon the nanowire structure has a first resistance value as measured between the first
11 terminal and the second terminal while the active surface is subjected to a first level of electro-
12 magnetic radiation, the nanowire structure having a second resistance value as measured between
13 the first terminal and the second terminal while the active surface is subjected to a second level
14 of electro-magnetic radiation.

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